

WHAT IS CLAIMED IS:

1. A lamp assembly comprising:
a lamp for producing light, the lamp having a surface and at least one contact extending from the surface for supplying electrical energy to the lamp, the contact having a surface for electrical contact extending substantially completely around an axis; and
a contact protector extending substantially around the contact and from approximately adjacent the base a distance from the base along the contact in such a way that the contact is accessible for electrical contact substantially completely around the surface of the contact.
2. The assembly of claim 1 wherein the lamp surface is the base of a bi-pin lamp and the contact is at least one of the pins and the pin is cylindrical.
3. The assembly of claim 2 wherein the contact protector extends around two pins.
4. The assembly of claim 2 wherein the contact protector extends from adjacent the base to a point beyond the ends of the contacts.
5. The lamp assembly of claim 1 wherein the contact protector is formed from an electrically insulating material.
6. The assembly of claim 5 wherein the contact protector includes a bore and a counterbore for surrounding a contact.
7. The assembly of claim 6 wherein the counterbore defines a wall surrounding the bore, wherein the bore contacts a portion of the contact, and wherein the wall has a thickness and the pin has a length, wherein the wall thickness is less than the pin length.

8. The assembly of claim 7 wherein a portion of the contact extends outwardly over the wall so that the wall is between the extended portion of the contact and the surface on the lamp.

9. The assembly of claim 5 wherein the contacts are pins and wherein the protector surrounds the pins.

10. The assembly of claim 9 wherein the protector includes at least one bore for surrounding at least one pin and wherein the bore includes a wall surrounding the pin such that the wall is spaced from the pin.

11. The assembly of claim 6 wherein the contacts include at least two pins, the contact protector extends to an end surface spaced from the lamp surface, wherein the pins extend from the lamp surface to pin ends and wherein the pin ends are recessed below the surface of the pin protector.

12. The assembly of claim 1 wherein the lamp contacts are each separated into at least two components, including a pin extending from the base of the lamp and a pin extender contacting and extending around at least a portion of the lamp pin.

13. The assembly of claim 12 wherein the pin extender holds the contact protector in place about the pins.

14. The assembly of claim 12 wherein the pin extenders completely encircle a surface of the pin.

15. A lamp combination, the combination comprising:
a lamp having a surface and an electrical contact extending along an axis from the lamp surface;
a contact protector having a protector surface adjacent the contact; and

a contact protector holder on the contact for holding the contact protector surface adjacent the contact such that a connector can supply electrical energy to the electrical contact by contacting the contact along the axis.

16. The combination of claim 15 wherein the protector holder encloses part of the contact.

17. The combination of claim 16 wherein the protector holder is an extension placed over the pin.

18. The combination of claim 17 wherein the pin extension holds the contact protector in place.

19. The combination of claim 15 wherein the contact protector has a second surface spaced from the lamp surface and wherein the contact has an end spaced below the second surface of the contact protector.

20. The combination of claim 19 wherein the contact protector holder is a contact extender holding the protector in place.

21. The combination of claim 15 wherein the protector is formed from an electrically insulating material.

22. The combination of claim 21 wherein the contact protector extends a longitudinal distance, wherein the electrical contact extends a longitudinal distance from the lamp surface, wherein the contact protector longitudinal distance is greater than the electrical contact longitudinal distance.

23. The combination of claim 22 wherein the lamp has at least two electrical contacts, wherein the contact protector includes surfaces adjacent each of the at least two

electrical contacts, wherein the contact protector extends a longitudinal distance greater than the longitudinal distance of each contact, and wherein the shortest unobstructed distance from one contact to another contact is no less than 0.246 inch.

24. The combination of claim 15 wherein the contact protector surface adjacent the contact is a circular wall about the contact.

25. The combination of claim 24 wherein the circular wall forms a bore extending from a point near the lamp surface past an end of the contact so that the contact is recessed at a point intermediate the ends of the bore.

26. A lamp assembly comprising:
a lamp having a surface and at least two conductive contacts for supplying electrical energy to the lamp; and
an insulator between the at least two conductive contacts such that the shortest distance between the at least two conductive contacts is no less than 0.246 inch.

27. A circuit for lighting a lamp, the circuit comprising:
an electronic ballast for operating at a frequency above 100 cycles per second and above 200 volts;

at least one lamp socket having contacts for supplying electrical energy to a lamp through the contacts, wherein the contacts have a surface area available for electrical contact of at least 0.008 inch square;

at least one electrical conductor for electrically coupling the ballast to the socket, wherein the conductor has a surface area available for electrical contact of at least 0.008 inch square; and

a junction between the at least one electrical conductor and the contacts of the at least one lamp socket for forming an electrical bridge between the at least one electrical conductor and the contacts wherein the bridge has a surface area available for electrical contact of at least 0.008 inch square.

28. The circuit of claim 27 wherein the contacts for the at least one lamp socket are at least partially cylindrical for accepting a pin for electrical contact.

29. The circuit of claim 27 wherein the contacts for the at least one lamp socket have an arcuate shape over a substantial surface area for contact with a mating electrical contact.

30. The circuit of claim 27 wherein the contact of the at least one lamp socket are adapted to contact with a mating contact through a longitudinal connection movement.

31. The circuit of claim 27 wherein the contacts for the at least one lamp socket are at least partially hollow cylindrical for accepting a complimentary pin contact, wherein the at least one electrical conductor includes wire having a size no smaller than 16 gauge, and wherein the junction includes a connector having a pin connector portion and a complementary mating hollow cylindrical connecting portion, and further including a lamp with pins electrically contacting the contacts on the at least one lamp socket.

32. The combination of claim 31 wherein the contacts of the at least one lamp socket engage the lamp pins over at least 180 degrees of the circumferential surface of the lamp pins.

33. The circuit of claim 32 wherein the contacts on the at least one lamp socket engage the pins on the lamp over at least 50 per cent of the length of the pins on the lamp.

34. The circuit of claim 27 further comprising a refrigerator display case frame wherein the electronic ballast is mounted in the frame and wherein the at least one lamp socket is supported by a portion of the frame.

35. The circuit of claim 34 further including a fluorescent lamp connected to two

lamp sockets, wherein each lamp socket includes hollow cylindrical contacts for engaging pins on the lamp.

36. The circuit of claim 27 further comprising a first electrical conductor for supplying electrical energy to a first contact in the at least one lamp socket, a second electrical conductor for supplying electrical energy to a second contact in the at least one lamp socket, and wherein the first conductor is soldered to the first contact and wherein the second conductor is soldered to the second contact.

37. The circuit of claim 27 wherein the junction includes at least one pin connector and at least one mating hollow cylindrical connector and wherein the connectors are enclosed in a plastic housing.

38. The circuit of claim 27 wherein the contacts for the at least one lamp socket are substantially circular.

39. The circuit of claim 38 wherein the contacts are split sleeve contacts.

40. The circuit of claim 39 further including a conductor crimped to each contact for supplying electrical energy to the contact from the at least one electrical conductor for electrically coupling the ballast to the socket.

41. A circuit for lighting a lamp, the circuit comprising:
an electronic ballast for operating at a frequency above 100 cycles per second and above 200 volts;
at least one lamp connector with contacts for supplying electrical energy to a lamp through the contacts, wherein the contacts have a surface area available for electrical contact of at least 0.008 inch square;
a fluorescent lamp coupled to the at least one lamp connector for producing light when energized with electrical energy from the lamp connector;

at least one electrical conductor for electrically coupling the ballast to the socket, wherein the conductor has a surface area available for electrical contact of at least 0.008 inch square; and

an connector between the conductor and the socket wherein the connector has a surface area available for electrical contact of at least 0.008 inch square.

42. The circuit of claim 41 wherein the contacts on the lamp connector are hollow substantially circular contacts and wherein the lamp includes pins for providing electrical energy to the lamp and wherein the pins are connected to the contacts on the lamp connector.

43. The circuit of claim 42 wherein the contacts on the lamp connector engage the lamp pins over a substantial arcuate surface area and wherein the connection extends for a longitudinal distance.

44. A ballast and lighting circuit for a refrigeration unit, the circuit comprising:
a source of electrical energy for the circuit;
an electronic ballast coupled to the source of electrical energy;
conductors coupled to the ballast for receiving electrical energy from the ballast;
at least one ballast connector for connecting the ballast to the conductors;
a fluorescent light source;
a connector for the fluorescent light source for coupling the fluorescent light source to the at least one ballast conductor; and

wherein the connector for the fluorescent light source includes a surface area for contacting contacts on the fluorescent light source having at least 0.01 inch square surface area available for electrical contact with the contacts on the fluorescent light source.

45. A connector for connecting contacts of a fluorescent light source to a source of electrical energy, the connector comprising:
an input conductor for receiving electrical energy from a ballast;

an output conductor adapted to accept a cylindrical conductive pin of a fluorescent light source to be illuminated; and

an electrical circuit between the input conductor and the output conductor for passing current from the input conductor and formed in such a way as to have a surface area available for electrical contact of at least 0.008 inch square.

46. The connector of claim 45 wherein the output conductor is formed from a hollow partially cylindrical conductor.

47. The connector of claim 46 wherein the surface area available for electrical contact is at least 0.05 inch square.

48. The connector of claim 46 wherein the electrical circuit is formed in such a way that the surface area available for electrical contact is approximately 0.07 inch square.

49. The connector of claim 45 wherein the connector includes two output conductors formed as split sleeve conductors for connecting two respective pins of a fluorescent light source.

50. The connector of claim 49 wherein the electrical circuit between the input conductor and the output conductor includes a first wire crimped to the first output conductor and a second wire crimped to the second output conductor and wherein the first wire is connected to a first input conductor through solder and wherein the second wire is connected to a second input conductor through solder.

51. The connector of claim 51 wherein the input conductor includes a connection for connecting to a conductor carrying electrical energy from a ballast wherein the junction includes pin conductors engaging hollow cylindrical mating conductors surrounded by plastic.

52. The conductor of claim 45 wherein the input conductor is formed from copper.

53. The connector of claim 52 wherein the input conductor is connected to a junction formed from a plastic enclosed pin conductor engaging a hollow cylindrical conductor.

54. The conductor of claim 45 wherein the input conductor is clamped to the output conductor.

55. The connector of claim 45 wherein the input conductor is soldered and the connector includes an intermediate conductor coupled to the output conductor.

56. The conductor of claim 45 wherein the input conductor is no smaller than 16 gauge wire.

57. The connector of claim 45 wherein the input conductor is electrically coupled to an electronic ballast.

58. The connector of claim 45 wherein the output conductor is formed as a cylindrical connector.

59. The conducted of claim 58 wherein the output conductor is formed from gold plated bronze.

60. The connector of claim 45 further including a contact protector protecting the output conductor.

61. The connector of claim 60 wherein the protector includes an end surface wherein the output conductor is recessed below the end surface.

62. The connector of claim 45 wherein the output conductor is engagable for passing electrical current through linear contact with a lamp connector.

63. The connector of claim 45 wherein the output conductor forms an electrical contact over an arcuate surface.

64. The connector of claim 63 wherein the output conductor is arcuate over at least 180°.

65. The connector of claim 45 further including a second output conductor for contacting respective pins of a bi-pin lamp.

66. The connector of claim 45 further including a second output conductor for electrically connecting two pins of a bi-pin lamp and third and fourth output conductors for electrically connecting two pins of a bi-pin lamp.

67. A connector for connecting electrical energy from a ballast to a fluorescent light source, the connector comprising:
an input circuit for receiving electrical energy;
a connector body for supporting the input circuit; and
a first output contact supported by the body for coupling to a first contact connected to a fluorescent light source and a second output contact supported by the body for coupling to a second contact connected to the light source wherein the first and second output contacts are separated by an unobstructed path no less than 0.246 inch.

68. A conductor for connecting electrical energy from a ballast to a fluorescent light source, the connector comprising:
an input circuit for receiving electrical energy;
a connector body for supporting the input circuit and having a base;

a first output contact supported by the body at the base for coupling to a first contact connected to a fluorescent light source and a second output contact supported by the body at the base for coupling to a second contact connected to the light source; and

a substantially nonconductive barrier between the first and second output contacts wherein the contacts are spaced from the barrier by an unobstructed path no less than 0.246 inch.

69. The connector of claim 68 wherein the first and second output contacts are substantially cylindrical output contacts.

70. The connector of claim 68 wherein the nonconductive barrier includes at least one cylindrical insulator sleeve around a portion of the first output contact.

71. The conductor of claim 70 wherein the barrier completely surrounds the first output contact.

72. The connector of claim 70 wherein the nonconductive barrier surrounds only a part of the first output contact.

73. The connector of claim 68 wherein the first second output contacts are spaced apart, and wherein the barrier includes the first and second sleeves around respective ones of the first and second output contacts.

74. The connector of claim 73 wherein the first and second output contacts include respective ends and wherein the contact ends are spaced below the ends of the barriers.

75. The connector of claim 74 wherein the first and second output contacts are spaced from their respective sleeves.

76. The connector of claim 75 wherein the first and second output contacts are substantially hollow cylindrical contacts.

77. The connector of claim 68 further including third and fourth output contacts wherein the first and second output contacts are configured to contact bi-pins of a T8-sized lamp and wherein the third and fourth output contacts are sized to contact pins of a T5 lamp.

78. The connector of claim 68 wherein the nonconductive barrier includes cylindrical walls around respective ones of the first and second output contacts.

79. The connector of claim 68 further including a bi-pin lamp connected to the connector wherein the first output contact connects to one pin of the bi-pin lamp and the second output contact connects to the second of the pins on the bi-pin lamp.

80. The connector of claim 68 wherein the input circuit includes first and second conductors and wherein the connector includes a nonconductive barrier separating the first and second conductors.